Government certification and IPO initial returns under the registration system: New evidence from Chinese stock markets

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Abstract

This study investigates the impact of government certification on Initial Public Offering (IPO) initial returns in the Chinese stock market after the registration-based reform. Employing stochastic frontier analysis (SFA), we decompose initial returns into deliberate underpricing and aftermarket mispricing components. Focusing on the "Specialized and Sophisticated Enterprises" (SSE) certification policy, we find that government certification significantly mitigates both components of the initial returns, with a more pronounced effect on national-level certifications. We also find the certification reduces the underpricing rate by reducing the volatility and fads in the IPO process, and SMEs benefit more than other companies from the certification policy. Our findings suggest that government certification plays a pivotal role in reducing initial returns in IPOs.

Keywords: IPO initial returns; Information asymmetry; Government certification; Stochastic frontier analysis
JEL classification: G14; G18; G32

1. Introduction

One of the most widely investigated phenomena in the finance literature is the price performance of initial public offerings (IPOs) of common stock (Aggarwal and Rivoli, 1990; Ritter, 1984 & 1991; Chan et al., 2004; Wang et al., 2018). In China, the high initial returns of IPOs are more pronounced than in developed countries (Cheung et al., 2009; Tian Li, 2011; Zhou et al., 2021). High initial returns can be explained by different theories, including information asymmetry theory by Rock (1986), the signaling theory developed by Allen and Faulhaber (1989), underwriter reputation (Carter et al., 1998; Hu et al. 2021), investor sentiment studied by Welch (1992), etc. Besides, the institutional environment and government policies are also proven to have effects on IPOs and their initial returns (Prasad et al., 2006; Zhang et al., 2017; Xu et al., 2024). The most recent institutional reform of Chinese IPO market is the registration-based reform carried out in 2019 and proven to improve IPO efficiency (Deng et al., 2024). Apart from the

institutional background, this study focuses on the role of government in the Chinese IPO market under the registration system in China and analyze whether a certification policy with a large cope of impact helps reducing IPO initial returns in China and hence improves the IPO pricing efficiency.

China's IPO market has gone through several reforms, and the government's role has varied at each stage of the reform, as shown in Table A1. Thus, there are different patterns of IPO initial returns among board markets and different roles of the government in the stock market. The registration-based IPO reform was initiated in 2018, where the first-day price change limit was removed. After the registration-based IPO reform, one of the key policies of the Chinese government to support local enterprises, especially small and medium-sized enterprises (i.e., SMEs), is the "Specialized and Sophisticated Enterprises" certification from June, 2019. The central and local governments certify some enterprises as "Specialized and Sophisticated Enterprises" (hereinafter referred to as SSE)[1]. The top performers with outstanding achievements are called "Little Giants", certified by the central government and characterized by their focus on niche markets, strong innovation capabilities, large market shares, and strengths in core technologies (Ministry of Industry and Information Technology of PRC, 2022). Figure 1 shows the number and average initial returns per three months of the sample that we choose from Chinese IPO market from 2019 to 2023, right after the reform of registration-based IPO regime and the policy of "Specialized and Sophisticated Enterprises" certification. It is noteworthy that the number of certified IPOs increases gradually after the introduction of the certification policy, as does the share of certified IPOs in the total number of IPOs.

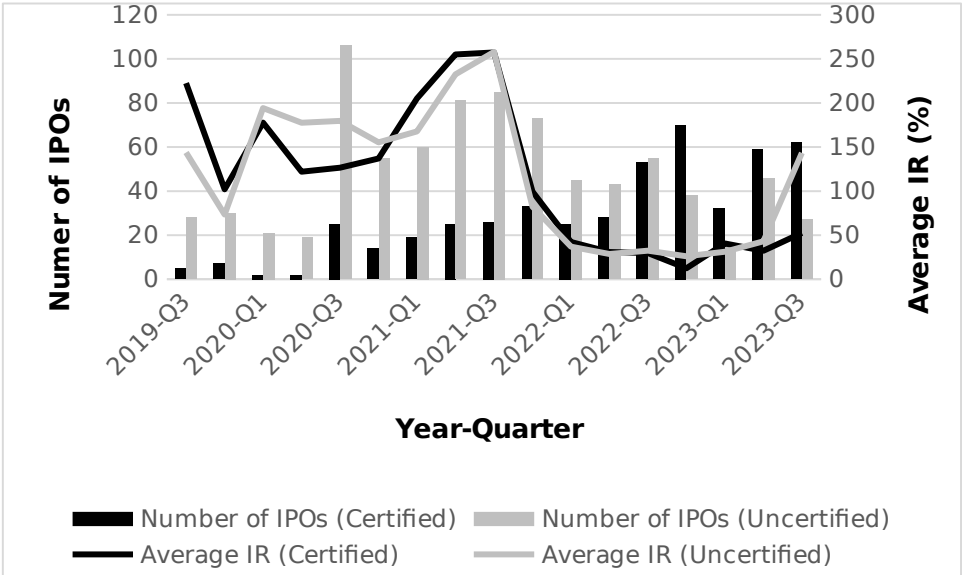

Figure 1. Numbers and average initial returns of IPOs in China from

[1] Those applying for certification must have an average year-on-year growth rate of at least 5% in their main business revenue or net profit over the past two years, and the ratio of liabilities to assets should not exceed 70%

2019 to 2023

This study focuses on the Chinese IPO market after the registration-based IPO regime since 2019, where there is no limit on the first-day change rate of price. This study explores whether a Chinese government certification policy “SSE” reduces the initial returns to IPOs in China. Initial returns are also decomposed into two components following Yan et al. (2010) and Song et al. (2014), and we examine the impact of the certification policy on each component separately. The paper also explores possible mechanisms and the unique impact of certification on SMEs.
This paper contributes to the previous literature in the following ways: First, we extend the literature on government policy and IPO initial returns by finding the negative correlation between SSE certification and IPO initial returns. Second, we further confirm that government policy can reduce volatility and fads in the IPO process through mechanism analysis, thus proving the signalling effect of government certification policy. Third, we also add content on the characteristics of the Chinese IPO market under the registration-based IPO reform, focusing not only on initial returns but also on their disentanglement: deliberate underpricing and also aftermarket mispricing. Our study suggests that policymakers should recognize the important role that government certification plays in mitigating information asymmetry and reducing IPO initial returns in the primary market.

2. Literature review

2.1 IPO initial returns: deliberate underpricing and aftermarket mispricing

The phenomenon of initial public offering (IPO) high initial returns, where the offering price is set below the subsequent market trading price, has been explained by a variety of theories. These theories basically explain IPO initial returns from two perspectives: deliberate underpricing and aftermarket mispricing, they are: The information asymmetry theory by Rock (1986) suggests that underpricing is a consequence of the information gap between issuers and investors, leading to the 'winner's curse' and the need for issuers to set lower prices to mitigate this risk. The signaling theory developed by Allen and Faulhaber (1989) posits that underpricing serves as a signal of a firm's unobservable quality, with higher quality firms willing to forgo short-term gains to signal their long-term potential. Yan et al (2019) find that uncertain or negative tone of IPO prospectuses is significantly associated with IPO initial returns. Carter et al. (1998) and Hu et al. (2021) emphasize the role of underwriter reputation, suggesting that prestigious underwriters can reduce underpricing by credibly signaling a firm's value to the market. The influence of investor sentiment, explored by Welch (1992),

suggests that investor sentiment can affect the demand for new issues and thus the level of underpricing.

The primary explanations for the deliberate underpricing are rooted in information asymmetry, where insiders have more information than potential investors, leading to the use of underpricing as a signaling mechanism to convey the value of the firm (Grinblatt and Hwang, 1989). On the other hand, aftermarket mispricing, which refers to post-IPO price deviations, is attributed to several factors. Early aftermarket trading activity, driven by investor optimism and potential overvaluation, is considered an important source of initial returns (Aggarwal and Rivoli, 1990; Ritter, 1991). In addition, aftermarket mispricing is associated with the volume of shares traded on the first day, the price adjustment from the offering range to the offer price, and the overall size of the offering. Underwriter price support has also been identified as a factor leading to aftermarket mispricing (Ruud, 1993; Asquith, Jones and Kieschnick, 1998). There are literature on decomposing the two parts in stock markets in the different countries (Reber & Vencappa, 2016; P Mulchandani et al., 2023).

2.2 The signaling effect of government policy

The concept of government signaling is pivotal in understanding the indirect impacts of policy on economic behavior. Shiller (1981) extends this discussion to the realm of financial markets, elucidating the influence of governmental announcements on stock price volatility and investor confidence. In the context of credit markets, Greenwald, Stiglitz, and Weiss (1984) examine the signaling role of government-backed loans, indicating borrower creditworthiness to potential lenders. Similarly, Leaven and Valencia (2010) explore how government guarantees can serve as signals affecting bank credit ratings. Sauermann and Blinder (2011) highlight the potential of government support to signal promising avenues for private investment. Meanwhile, Acharya, Engle, and Richardson (2012) delve into the signaling effects of government interventions during financial crises, revealing the government's role in restoring market confidence. This literature underscores the multifaceted nature of government signaling, which can influence a range of economic decisions, from resource allocation and credit assessments to investment behaviors during periods of economic uncertainty. In China and other countries, recent government interventions and policies have been proven to affect the stock market and IPO pricing efficiency (Liao X, 2024; Wang et al., 2021; Li et al., 2023).

However, few studies have focused on the government's signaling role in the asymmetric information IPO market. In a stock market with an evolving regulatory regime such as China's, it is important to focus on the role of the government.

3. Data and methodology

3.1 Data

The data in this study are mainly sourced from the Wind Financial Database, prospectuses and annual reports of listed companies. The sample selected for this study is stocks listed on all A-share boards since 30 September 2019, immediately after the registration-based reform, with no upper and lower limit on the offer price, that is, all A-share listed companies listed on SSE STAR Board since July, 2019, the Second Board since August, 2020, and the Beijing Stock Exchange since July, 2020, and on the Main Board since March 29, 2023. A series of IPO, company and industry characteristics are collected through the Wind's API data interface in Excel. According to the above screening criteria, a total of 1,312 listed firms are selected and information from their prospectuses on whether they have received national/provincial/city level certifications is acquired.

3.2 Definition and measurements of variables

3.2.1 Independent variables

This study focuses on a few dependent variables: initial returns (IR), market-adjusted initial returns (aIR) that can represent the abnormal initial returns (Aggarwal & Rivoli, 1990)), deliberate underpricing rate (Dup) resulting from the risk of the firm or characteristics pre-offering process, aftermarket mispricing (Msp) due to aftermarket characteristics. According to Reber & Vencappa, (2016) and P Mulchandani et al. (2023), the initial returns (IR) can be decomposed into deliberate underpricing rate (Dup) and aftermarket mispricing (Msp).

The initial returns for each IPO is the increase or decrease of the closing price on the first day of IPO compared to the offering price, as shown in $Eq.(1)$; and the market adjusted initial returns is calculated by the changing rate of the market indexes subtracted from the initial returns (Carter et al., 1998), as shown in $Eq.(2)$:

$$IR_{i,t}=\frac{P_{i,t}-P_{i,0}}{P_{i,0}}(1)$$

$$aIR_{i,t}=\frac{P_{i,t}-P_{i,0}}{P_{i,0}}-\frac{I_{i,t}-I_{i,0}}{I_{i,0}}(2)$$

where $P_{i,t}$ is the closing price of the stock i, t trading days after the initial offering, and represents the first-day return when $t=1$, and $P_{i,0}$ is the initial offering price of the stock; $I_{i,t}$ is the closing price of different value-weighted market price indexes or the composite of them, such as CSI 300 and STAR-50 index, as explained in Appendix 1.

On the first trading day, the excess return can result from the deliberate underpricing, or the aftermarket mispricing, or both. Given the observed initial offer price $P_{i,0}$, the efficient IPO price frontier can be estimated by the Stochastic Frontier Analysis (SFA) method (Hunt-McCool et al., 1996), as well as the systematic deliberate underpricing Dup (Jondow et al., 1982) and the inefficiencies in early aftermarket trading, that is, the aftermarket mispricing Msp. The estimation method is elaborated in Section *3.3*.

3.2.2 Dependent variables

The primary concern of this study is the role of government certification on IPO in, so a dummy variable is constructed as an indicator: IPO_C. If there is at least one certification of SSE in the firm's prospectus, IPO_C is assigned to the value of 1 regardless of the level of government that grants it, otherwise 0;

To distinguish different administrative levels of certification governments, two more dummy variables are constructed: If the firm has obtained the national "Little giants", then the variable for national certified IPO_{NC} is 1, otherwise it is 0; if the firm has obtained the provincial/municipal certification only, then the variable $IPO_{\text{ç}}$ is 1, otherwise it is 0.

3.2.3 Control variables

From Figure 1, the time of IPO may affect the effect of government certification. Following Yung et al. (2008), we define that 'Hot market' is when the number of IPOs that month is 50% greater than the three-monthly moving average of that month. 'Cold market' is when the number of IPOs that month is 50% smaller than the three-monthly moving average of that month. All other months are defined as 'normal market'.

Table 1 outlines key variables for analyzing IPOs, focusing on initial offer price in SFA, incorporating Fama & French pricing factors & industry dummies. To study underpricing, we follow Kumbhakar & Lovell (2000) by integrating exogenous factors affecting inefficiency, including firm, third-party, & IPO market dynamics. Market conditions are classified as 'Hot',

'Cold', or 'Normal' based on Ritter et al.'s methodologies. Our aftermarket mispricing model considers trading volume, ownership concentration, & underwriter reputation. The financial return model includes government certification, underpricing & aftermarket controls, plus political & regulatory variables like state ownership & largest shareholder's shareholding, offering a comprehensive analysis.

Table 1. Definition of variables

Variable	Definition
	Stochastic Frontier Model (SFA)
Dependent variable	
P_0	Initial offer price per share in RMB.
Pricing factors	
log ¿)	Natural logarithm of the company's net income in RMB 10,000 in the accounting period before IPO.
log ¿)	Natural logarithm of the company's total assets in RMB 10,000 in the accounting period before IPO.
log ¿)	Natural logarithm of the company's capital expenditure in RMB 10,000 in the accounting period before IPO.
$Leverage$	Leverage ratio, ratio of a firm's debt-to-equity in the accounting period before IPO.
$EBTITA$	Earnings before interest, tax, depreciation and amortization in RMB 10,000 in the accounting period before IPO.
Underpricing factors	
Age	Number of years between the date the company was founded and the IPO date
log ¿)	Natural logarithm of the company's revenue in RMB 10,000 in the accounting period before IPO.
$Equity\,retained$	Leland and Pyle's (1977) signal of equity retained: $\alpha = RET + \ln(1 - RET)$, where RET is the proportion of equity retained by pre-IPO shareholders in the post-IPO firm.
$Reputation$	Underwriter reputation, 1 if lead underwriter ranking is among the top 10, 0 otherwise.
Fee	Underwriting fees in RMB 10,000.
Hot_{market}	Dummy variable, if the number of IPOs that month is 50% greater than the three-monthly moving average of that month, $Hot_{market} = 1$, otherwise $Hot_{market} = 0$
$Cold_{market}$	Dummy variable, if the number of IPOs that month is 50% smaller than the three-monthly moving average of that month,

$Cold_{market}=1$, otherwise $Cold_{market}=0$	
Aftermarket mispricing model	
Dependent variable	
Msp	Aftermarket mispricing component of initial returns recovered after estimation of deliberate underpricing.
Independent variables	
$Volume\%$	The trading volume on IPO day divided by the total number of shares.
$Equity\,retained$	Equity retained: $\alpha=RET+\ln(1-RET)$, where RET is the proportion of equity retained by pre-IPO shareholders in the post-IPO firm.
$Reputation$	Underwriter reputation, 1 if lead underwriter ranking is among the top 10, 0 otherwise.
$\log(proceeds)$	Natural logarithm of the number of shares offered in the IPO divided by 10,000.
$\log(outissue)$	Natural logarithm of the number of outstanding shares offered in the IPO multiplied by the offer price in RMB 10,000.
Initial returns model	
Dependent variables	
IR	The increase or decrease of the closing price on the first day of IPO compared to the offering price
aIR	The market-adjusted initial returns calculated by the changing rate of the market indexes subtracted from the initial returns IR.
Independent variables	
IPO_C	Dummy variable, if a firm is certificated as an SSE, regardless of national or provincial/municipal, IPO_C = 1, otherwise IPO_C = 0
IPO_{NC}	Dummy variable, if a firm is certificated as a national SSE, i.e., Little Giant before listing, then IPO_{NC} = 1, otherwise IPO_{NC} = 0
$IPO_{¿}$	Dummy variable, if a firm has only obtained a provincial/municipal SSE certification before listing, then $IPO_{¿}$ = 1, otherwise $IPO_{¿}$ = 0
Control variables	
$\log$ ¿)	Natural logarithm of the company's total assets in RMB 10,000 in the accounting period before IPO.
$Leverage$	Leverage ratio, ratio of a firm's debt-to-equity in the accounting period before IPO.
Age	Number of years between the date the company was founded and the IPO date
$\log$ ¿)	Natural logarithm of the company's revenue in RMB 10,000 in the

	accounting period before IPO.
$Equity\,retained$	Leland and Pyle's (1977) signal of equity retained: $\alpha = RET + \ln(1 - RET)$, where RET is the proportion of equity retained by pre-IPO shareholders in the post-IPO firm.
$Reputation$	Underwriter reputation, 1 if lead underwriter ranking is among the top 10, 0 otherwise.
Fee	Underwriting fees in RMB 10,000.
EPS	Price-to-Earnings Ratio of the industry in which the IPO company operates.
$\log(outissue)$	Natural logarithm of the number of outstanding shares offered in the IPO multiplied by the offer price in RMB 10,000.
$\log(proceeds)$	Natural logarithm of the number of shares offered in the IPO divided by 10,000.
Hot_{market}	Dummy variable, if the number of IPOs that month is 50% greater than the three-monthly moving average of that month, $Hot_{market} = 1$, otherwise $Hot_{market} = 0$
$Cold_{market}$	Dummy variable, if the number of IPOs that month is 50% smaller than the three-monthly moving average of that month, $Cold_{market} = 1$, otherwise $Cold_{market} = 0$
$First_{holder}$	Shareholding of the largest shareholder at the time of the firm's IPO
$State_{own}$	Dummy of the corporate ownership, 1 if the real controller belongs to a central or local state-owned enterprise, otherwise 0
$\log(Raise)$	The logarithm of the size of the firm's IPO fundraising

Table 2 presents descriptive statistics for our sample, segmented by board market. The average initial returns (IR) is 113.1%, significantly above the 44% cap prior to the 2019 reform, with a standard deviation of 160.59, reflecting variability in price changes. The Second and SSE STAR markets exhibit higher initial returns, while the Beijing Stock Exchange (BSE) shows the lowest, with debut declines across all markets. Government certification is received by 37% of companies, with national and provincial/municipal certifications at 18% and 19% of the sample, respectively. The Main board and Beijing Stock Exchange have the highest certification rates. In terms of initial offer price, SSE-STAR companies have the highest, contrasting with the lowest in the BSE market. Main board companies lead in fund raising, asset size, and leverage, indicating higher investment risk, and also face higher underwriter fees. The SSE STAR market is distinguished by rapid growth and R&D focus, with younger firms showing the steepest sales growth and the highest R&D investment. Conversely, the BSE lists the most companies during 'Hot' market periods.

Table 2. Summary Statistics

Variable	Observ-ations	Mean					Std. dev.	Min	Max
		Whole	Main	Second	SSE STAR	BSE			
IR	1312	113.27	63.83	141.14	124.87	25.25	160.59	-36.04	1942.58
IPO_C	1312	0.37	0.54	0.32	0.33	0.56	0.48	0.00	1.00
IPO_{NC}	1312	0.18	0.29	0.14	0.16	0.27	0.38	0.00	1.00
IPO_{i}	1312	0.19	0.25	0.18	0.17	0.29	0.40	0.00	1.00
$First_{holde}$	1312	33.93	44.62	36.91	30.35	35.00	14.75	0.00	89.99
$State_{own}$	1312	0.08	0.25	0.05	0.10	0.09	0.27	0.00	1.00
$\log(Rais$	1312	1.91	2.58	2.02	2.34	0.53	0.98	-1.03	6.28
P_0	1312	32.63	23.73	34.29	40.03	11.08	35.67	1.22	557.80
log ¿)	1306	1.82	3.12	2.05	1.78	1.24	1.08	-4.61	7.44
log ¿)	1312	2.20	3.30	2.27	2.37	1.52	0.94	-0.54	7.44
log ¿)	1054	3.65	3.63	3.67	3.65	3.61	1.54	-2.37	9.45
$Leverag$	1312	37.01	46.52	37.75	35.90	37.10	17.20	2.77	97.42
$EBTITA$	1312	20066.02	90882.88	22469.21	19422.73	8478.55	51864.19	-170039.00	928349.00
Age	1312	16.14	17.74	16.89	14.63	18.05	5.99	3.47	41.87
log ¿)	1307	6.43	7.72	6.67	6.39	5.86	1.10	-0.73	12.05
$Equity re$	1312	76.86	79.38	77.93	80.23	65.64	9.60	2.00	100.00
$Reputati$	1312	0.50	0.54	0.43	0.62	0.33	0.50	0.00	1.00
Fee	1312	65.09	92.75	66.26	82.80	14.60	54.23	2.43	691.99
EPS	1312	1.12	1.08	1.43	0.99	0.75	1.53	-10.49	22.11
Hot_{market}	1312	0.38	0.00	0.38	0.37	0.47	0.49	0.00	1.00
$Cold_{marke}$	1312	0.01	0.00	0.00	0.03	0.02	0.12	0.00	1.00
$\log(outis$	1312	3.42	4.17	3.32	3.48	3.42	0.77	1.75	8.82
$\log(proc$	1312	8.02	8.81	7.99	8.22	7.51	0.78	4.79	12.64
$Volume\%$	1312	2830.4	7848.0	2213.9	3854.9	1111.	6878.2	156.35	144420

	7	7	1	3	52	4		.80

3.3 Methodology

The Stochastic Frontier Analysis (SFA) method by Hunt-McCool et al. (1996) is widely used to test for deliberate underpricing in Initial Public Offerings (IPOs). The SFA model suggests that the maximum price with full market info is on the frontier. Random deviations indicate no systematic underpricing, but deliberate underpricing creates a gap, identifiable through skewed residuals in the estimation. This study combines SFA with OLS to determine the proportion of deliberate and aftermarket mispricing in initial returns and tests the impact of government certification on these aspects. First, The SFA model for this study is as follows:

$$P_{0i} = \alpha + x'_i\beta + \epsilon_i \left(i = 1, \ldots, N\right) (3)$$

$$\epsilon_i = v_i - u_i (4)$$

$$v_i \quad N(0, \sigma_v^2) (5)$$

$$u_i \quad F(6)$$

Where for (3), P_{0i} represents the observed initial offer price, x_i is a vector of pricing factors and β is the vector of coefficients to be estimated. The error term ϵ_i is composed of a normally distributed error v_i as in (4), which represents measurement and specification error, and a one-side disturbance, u_i, representing inefficiency. u_i and v_i are assumed to be independent of each other and i.i.d. across observations. The distribution F of the inefficiency term u_i are assumed to different distributions to be estimable: Half-normal distribution (Aigner et al., 1977), i.e. $u_i \quad N^{+¿(0,\sigma_u^2)¿}$, exponential distribution (Meeusen and van den Broeck, 2017), i.e., $u_i \quad E\left(\sigma_u\right)$, truncated normal distribution (Stevenson, 1980), and others.

The SFA method can be conducted by two sequential steps: First,

estimated the parameters $\hat{\theta}$ in the model by Maximum Likelihood (ML), or modified ordinary least squares (OLS) and generalized method of moments (GMM) estimators, where $\theta=(\hat{\alpha},\beta',\sigma_u^2,\sigma_v^2)$'. In the second step, we can obtain the point estimates of inefficiency by the mean or the mode of the conditional distribution of $f(u_i \vee \hat{\epsilon}_i)$, where $\hat{\epsilon}_i=P_{0i}-\hat{\alpha}-x'_i\hat{\beta}$.

Since $\epsilon_i=v_i-u_i$, then the p.d.f. of ϵ_i is the convolution of the densities of u_i and v_i as:

$$f_\epsilon(\epsilon_i)=\int_0^{+\infty} f_u(u_i) f_v(\epsilon_i+u_i)\, du_i \quad (7)$$

When MLE is used to estimate (7), then the log-likelihood function for estimating parameters is:

$$l(\theta)=\sum_{i=1}^{n} \log f_\epsilon(\epsilon_i \vee \theta) \quad (8)$$

After estimating for the residuals $\hat{\epsilon}$, the marginalization of the inefficiency component u_i can be modelled by Normal-Half Normal (Aigner et al., 1977), Normal - Exponential (Meeuse and van den Broeck, 1977), Normal-Truncated Normal (Stevenson, 1980) for cross-sectional data.

The second step for estimation is to disentangle the unobserved inefficiency component from the compounded error. We follow Jondrow et al. (1982) and Battese and Coelli (1988), to exploit a point estimate of the inefficiency term using the mean of the conditional distribution of u given ϵ, i.e., $E(u \vee \hat{\epsilon})$.

One of the key issues in SFA method is to include exogenous variables that may affect the distribution of inefficiency. In this study, we follow (SFA) to use simultaneous estimation, and combine the estimation method from Caudill and Ford (1993), Caudill et al. (1995) and Hadri (1999) to parametrize the variance of the inefficiency distribution, which is:

$$u_i \quad N^{+¿}(0,\sigma^2_{ui})(9)¿$$

$$\sigma_{ui}^2 = \exp(z'_i \varphi) \quad (10)$$

And z_i is a vector of exogeneous variables, φ is the vector of unknown parameters to be estimated (underpricing factors).

After the SFA model, we can determine an estimate of aftermarket mispricing after measuring the price frontier and the inefficiency component, we can then determine whether government certification affects which, or both of the component of the initial returns.

Then the baseline regression models for deliberate underpricing, aftermarket mispricing, initial returns and market-adjusted returns are constructed as in (11) and (12).

$$UP_{ijkl} = \alpha_0 + \alpha_1 IPO_{Ci} + \alpha_2 Controls_{ik} + b_j + \eta_k + \gamma_l + \epsilon_{ijkl} \quad (11)$$

$$UP_{ijkl} = c_0 + c_1 IPO_{NCi} + c_2 IPO_{Ci} + c_3 Controls_{ik} + b_j + \eta_k + \gamma_l + \varepsilon_{ijkl} \quad (12)$$

Where UP_{ijkl} represents in industry k, the interested independent variables, including: the deliberate underpricing Dup, aftermarket mispricing Msp, initial returns IR and market-adjusted returns aIR of firm i going public on board j in province l. $Controls_i$ represents a series of control variables in Table 1, b_j, η_k and γ_l represent board, industry and province fixed effect, ϵ_{ijkl} and ε_{ijkl} are the error terms.

4. Empirical Results

4.1 Disentangling deliberate underpricing and aftermarket mispricing

The deliberate premarket underpricing is identified from the asymmetric component of the variance in SF model in section 3.3. In model (2) and (3) in Table 3, the regression model is augmented with controlling industry dummies in the pricing model and market activity in the underpricing model. In Panel A, net income, capital expenditure and the leverage ratio are significant pricing factors, and the company's revenue, age, equity retained, underwriter fees and the dummy variable for hot market are all significant

underpricing factors.

In Panel C, the range of the estimates of deliberate underpricing are from 103.51% to 106.89% based on the complexity of the regression models, converging to approximately 103.5%. The aftermarket mispricing is calculated by subtracting the deliberate underpricing from the initial returns, as shown in Panel C, the range of aftermarket mispricing is from 20.97% to 24.32%, and the rate converges to approximately 24.3%.

In Panels D & E, OLS regression measures the relation between deliberate premarket underpricing, aftermarket mispricing, & initial returns variation. Coefficients are positive & significant, with higher R-squared for aftermarket mispricing (33%+) vs deliberate underpricing (9%). This suggests aftermarket mispricing explains initial returns variation better. Both explain initial returns to some extent, with about 0.3% & 0.5% changes for 1% variations in underpricing and mispricing, respectively.

Results in Table 3 show that deliberate underpricing is the dominant component of initial returns and explains some of the variation in initial returns. However, the variation of aftermarket underpricing turns out to be a greater contributor for the variation of initial returns, which is hypothesized to be due to the existence of fads or speculative bubbles (Aggarwal & Rivoli, 1990; Hanley et al., 1993; Ruud, 1993).

From the disentanglement of the initial returns to deliberate underpricing and aftermarket mispricing, we can assume that the government certification will have an impact on one or both of the components if it plays a part in the variation of the initial returns in general.

Table 3. Estimates of stochastic pricing frontiers and deliberate premarket underpricing

	(1)	(2)	(3)
Panel A: Pricing factors			
log ¿)	2.792*	2.760*	2.773*
	(1.624)	(1.673)	(1.672)
log ¿)	-1.019	-0.752	-0.755
	(1.874)	(1.868)	(1.868)
$\log(Capaex)$	-1.662**	-1.665**	-1.673**
	(0.679)	(0.675)	(0.675)
$Leverage$	-0.248***	-0.227***	-0.226***
	(0.0703)	(0.0705)	(0.0705)
$EBTITA$	-1.33e-05	4.30e-06	4.15e-06
	(2.97e-05)	(3.30e-05)	(3.30e-05)
Communications and software		47.24	47.23
		(34.09)	(34.09)
Manufacturing		36.83	36.80
		(33.76)	(33.76)

Architecture		26.70	26.71
		(37.05)	(37.05)
Real estate		34.70	35.30
		(49.16)	(49.32)
Retail		27.44	27.32
		(34.52)	(34.52)
Energy		11.42	11.62
		(39.77)	(39.79)
Scientific instruments		46.56	46.52
		(34.04)	(34.04)
Panel B: Underpricing factors			
log ¿)	0.353***	0.314***	0.317***
	(0.0405)	(0.0411)	(0.0412)
Age	0.0119**	0.0122**	0.0124**
	(0.00535)	(0.00543)	(0.00545)
Equity retained	0.0239***	0.0289***	0.0289***
	(0.00332)	(0.00344)	(0.00345)
Fee	-0.0630***	-0.0619***	-0.0620***
	(0.00288)	(0.00288)	(0.00290)
Reputation	0.0848	0.0727	0.0714
	(0.0644)	(0.0657)	(0.0658)
Hot_{market}			0.130**
			(0.0626)
$Cold_{market}$			-0.0195
			(0.332)
Panel C: Components of initial returns			
Initial returns (%)	113.27	113.27	113.27
Deliberate premarket underpricing (%)	106.89	103.51	103.54
Aftermarket mispricing (%)	20.97	24.35	24.32
Panel D: OLS of initial returns on deliberate underpricing			
Deliberate premarket underpricing	0.280***	0.307***	0.310***
	(0.0300)	(0.0293)	(0.0289)
R^2	0.079	0.095	0.099
Panel E: OLS of initial returns on aftermarket mispricing			
Aftermarket mispricing	0.497***	0.497***	0.490***
	(0.0200)	(0.0212)	(0.021)
R^2	0.357	0.343	0.334
Observations	1,312	1,312	1,312

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

4.2 The role of government certification in reducing underpricing

4.2.1 Government certification and overall initial returns

Table 4 shows the effects of government certification on overall initial returns. Column 1-3 are results for the effects of all levels of government certification of SSE on overall initial returns, and results of column 2 and 3 are acquired by more complex models than column 1, with third-party control variables for column 2 and third-party control variables as well as board market, industry and province fixed effects for column 3. We see that SSE certification significantly reduces the initial returns of IPO companies by 37.07% after controlling for all variables. Column 4-6 report the results of IPO_{NC} and $IPO_{¿}$. National-level certification has a more significant impact on reducing the initial returns, with a percentage of about 48.50%, while provincial and municipal-level certification has a much smaller effect of only about 26.88%. Therefore, the national “Little Giant” certification for enterprises is 80.43% more effective in reducing the initial returns than the provincial/municipal certification. Apart from government certification, most of the variables of firm characteristics have significant effect on overall initial returns, as well as the underwriter fee and the dummy variable for hot market activity, from which we know that issuing companies with higher underwriter fee and issued in a “hot market” month turn out to have higher initial returns, and the latter indicates the possibility of the existence of fads or speculative bubbles. The results are consistent with previous studies on government subsidies and their signaling effects. We have also conducted correlation tests on all control variables to exclude the possible impact caused by multicollinearity. The results are shown in Table A2 in the appendix.

Table 4. The effects of government certification on initial returns

Dependent variable: Initial returns (IR)	(1)	(2)	(3)	(4)	(5)	(6)
IPO_C	-48.72***	-40.60***	-37.07***			
	(8.491)	(8.135)	(8.300)			
IPO_{NC}				-66.50***	-51.99***	-48.50***
				(11.68)	(10.55)	(10.63)
$IPO_{¿}$				-33.46***	-30.58***	-26.88***
				(11.24)	(10.05)	(10.19)

Leverage	-0.435	-0.801***	-0.622**	-0.379	-0.788***	-0.608**
	(0.266)	(0.259)	(0.257)	(0.284)	(0.259)	(0.257)
$\log(asset)$	0.717	29.89***	21.75***	-5.732	29.80***	21.45***
	(7.352)	(7.887)	(7.979)	(7.813)	(7.881)	(7.975)
EPS	-8.217***	-5.650**	-7.646***	-9.741***	-5.595**	-7.631***
	(2.761)	(2.666)	(2.631)	(2.938)	(2.664)	(2.629)
$First_{holder}$	-0.453	-0.591**	-0.512*	-0.519*	-0.601**	-0.522*
	(0.287)	(0.274)	(0.282)	(0.305)	(0.274)	(0.282)
$State_{own}$	21.11	7.650	31.04**	21.59	7.686	31.11**
	(15.73)	(15.15)	(15.47)	(16.76)	(15.14)	(15.46)
log ¿)	2.637	-1.701	-1.070	0.0779	-1.712	-0.997
	(6.196)	(5.947)	(6.035)	(6.596)	(5.942)	(6.030)
Age	-0.325	-1.000	-0.785	0.113	-0.969	-0.762
	(0.685)	(0.662)	(0.655)	(0.729)	(0.662)	(0.654)
Equity retaine	2.445***	2.741***	1.056**	3.297***	2.721***	1.036**
	(0.445)	(0.427)	(0.489)	(0.468)	(0.427)	(0.489)
Volume%	384.8***	380.0***	317.5***		379.4***	316.6***
	(28.64)	(27.80)	(28.54)		(27.78)	(28.53)
Fee		-0.623***	-0.845***		-0.623***	-0.843***
		(0.0892)	(0.0944)		(0.0891)	(0.0944)
Reputation		-3.542	-3.721		-3.552	-3.707
		(8.201)	(8.184)		(8.195)	(8.178)
Hot_{market}		68.32***	63.12***		67.04***	61.97***
		(8.085)	(7.986)		(8.115)	(8.007)
$Cold_{market}$		25.38	38.19		24.60	37.67
		(32.32)	(31.54)		(32.30)	(31.51)
Fixed Effects	No	No	Yes	No	No	Yes
Observations	1,312	1,312	1,312	1,312	1,312	1,312
R-squared	0.222	0.243	0.421	0.224	0.244	0.422

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

4.2.2 Government certification and components of initial returns

Table 5 reveals that government certification notably decreases both deliberate underpricing (by 24.53%) and aftermarket mispricing (by 19.58%). National and provincial/municipal certifications have similar effects on underpricing. However, national certification specifically curbs aftermarket mispricing by 33.06%, compared to 19.58% of a general certification. Notably, in the mispricing model, the IPO day's trading volume relative to total shares is significant and positively impacts mispricing,

aligning with the findings by Aggarwal (2000, 2003), Ellis et al. (2000) and Reber & Vencappa (2016).

Table 5. The effects of government certification on deliberate underpricing and aftermarket mispricing

	(1)	(2)	(3)	(4)
	Deliberate Underpricing		Aftermarket Mispricing	
IPO_C	-24.53**		-19.58*	
	(9.996)		(10.99)	
IPO_{NC}		-23.02*		-33.06**
		(13.47)		(14.72)
$IPO_{\text{¿}}$		-25.62**		-9.686
		(11.95)		(13.12)
$\log(revenue)$	16.21***	16.21***		
	(4.708)	(4.710)		
Age	1.753**	1.749**		
	(0.776)	(0.776)		
Fee	-0.924***	-0.925***		
	(0.103)	(0.103)		
Hot_{market}	23.89**	24.00**		
	(9.315)	(9.342)		
$Cold_{market}$	36.92	36.88		
	(37.38)	(37.40)		
$Equity\,retained$	2.399***	2.401***	-1.818**	-1.857**
	(0.593)	(0.593)	(0.828)	(0.828)
$Reputation$	-1.278	-1.284	13.27	13.41
	(9.429)	(9.433)	(10.25)	(10.24)
$Volume\%$			161.2***	160.2***
			(35.68)	(35.67)
$\log(outissue)$			-20.55	-21.29
			(21.61)	(21.61)
$\log(proceeds)$			-16.67	-16.09
			(22.42)	(22.42)
Fixed Effects	Yes	Yes	Yes	Yes
Observations	1,312	1,312	1,312	1,312

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

4.3 Mechanism analysis

4.3.1 Volatility rate

To further test how government certification affects initial returns, we follow Ritter (1984) and Hu et al. (2021) and use the daily stock return volatility[2] based on daily data since listing as a proxy of the uncertainty about the firm's fundamental information. In Table 6, Columns 1-2, 3-4 and 5-6 are results of the volatility rate from 2nd trading day to 30th, 126th, and 250th trading day, respectively. We can infer from the results that government certification reduces the information asymmetry and hence reduce the initial returns, since the volatility is significantly positively correlated with the initial returns and government certification has a significant negative effect on volatility, except for the long-term volatility of 250 days.

Table 6. Volatility, government certification and aftermarket mispricing

	(1)	(2)	(3)	(4)	(5)	(6)
	$Volatility_{3}$	IR	$Volatility_{1}$	IR	$Volatility_{2}$	IR
IPO_C	-0.318**	-33.53***	-0.248***	-33.58***	-0.110*	-36.00***
	(0.127)	(8.149)	(0.0737)	(8.251)	(0.0569)	(8.268)
$Volatility_{30}$		13.70***				
		(1.816)				
$Volatility_{126}$				17.35***		
				(3.157)		
$Volatility_{250}$						17.07***
						(4.107)
Control Vari	Yes	Yes	Yes	Yes	Yes	Yes
¿ Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observation	1,312	1,312	1,312	1,312	1,312	1,312

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

4.3.1 Fads

In section 4.2.2, it's noted that government certification mitigates aftermarket mispricing, partly due to fads—a temporary overvaluation stemming from investor over-optimism (Camerer, 1989; Debondt and Thaler, 1985; Shiller, 1984). Fads can emerge in early trading due to: 1) uncertainty in intrinsic value estimation; 2) increased noise trading in riskier securities

[2] Volatility rate: $\{\sum$ ¿¿, where $R_i=\frac{EP_i}{BP_i}-1$, EP_i is the closing price of the last trading day in the time range, and BP_i is the previous closing price of the initial trading day.

(Trueman, 1988); 3) higher price volatility from speculative investors; and 4) over-optimism of marginal buyers, especially with small security supplies and divergent value estimates (Miller, 1977).

From the literature and 4.2.2's findings, we deduce that fads, driven by irrational exuberance, increase uncertainty around intrinsic values, leading to stock abnormal returns. This overoptimism likely results in high demand and trading volumes post-IPO (Aggarwal, 2000 & 2003; Ellis et al., 2000 & 2002). To detect fads, one should assess IPO price behavior against the fad theory. If the market efficiently values new issues, first-day returns should match the market index (Aggarwal & Rivoli, 1990). Conversely, underperforming the market index means IPOs are systematically overvalued in early trading.

Table 7 reflects the adjusted returns that represent the amount by which the price appreciation of the IPOs exceeds that of the CSI 300 index. We can see from the results that except for year 2019 and year 2020, when there are less 25% of the IPOs of the whole sample, in most of the years IPOs underperform the market index. These results can be evidence confirming the presence of fads under the implicit assumption that the systematic risk of IPOs is approximately the same as that of the index. According to Ibbotson (1975), IPO betas decline over time but remain above 1 in the year following the IPO, so the existence of fads cannot be directly inferred from the results of each year. However, since there is generally a rising market during the whole period from 2019 to 2023 measured by CSI 300, so we can infer that there are fads since the market-adjusted returns are negative and significantly smaller than 0, which means that most of the IPOs we study underperform the market after a year of issuance.

Research indicates a link between initial returns and aftermarket trading volume (Aggarwal, 2000, 2003; Chahine, 2007; Ellis et al., 2000, 2002). To examine if government certification mitigates fad-induced aftermarket mispricing, we analyze trading volumes on the 1st, 10th, 30th, and 90th days post-IPO. Table 8 reveals that certification significantly lowers volumes on the first day and beyond, suggesting it may decrease information asymmetry and fads-driven trading.

Table 7. Adjusted returns from offering date to one year following (250th trading day) for total sample and by year

Year	Mean	Standard Deviation	Median	t-statistics	Observations
All	-0.070	0.138	-0.097	-18.3***	1,312
2019	0.255	0.030	0.241	71.2***	70
2020	0.086	0.123	0.035	11.0***	244
2021	-0.192	0.035	-0.193	-110***	402
2022	-0.081	0.047	-0.078	-32.3***	354

2023	-0.102	0.037	-0.097	-43.5***	242

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 8. Early market trading volume between IPOs with and without government certification

Variable: Trading volume in 10,000 shares	Uncertified	Certified	Difference	t-statistics
1st trading day	3395.77	1872.81	1522.97	3.90***
10th trading day	883.06	463.89	419.17	3.63***
30th trading day	448.74	274.96	173.79	3.99***
90th trading day	274.55	172.19	102.36	4.01***

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

4.4 Further analysis

4.4.1 Robustness checks

To account for the effect of stock market ups and downs on the IPO initial returns, the adjustment is made by subtracting the first-day change from the change in the market index change on that day (two indexes construction is elaborated in Appendix 1), as in Section 3.2. The adjusted results are shown in Table 9, where columns 1-2 are from method (1), and column 3-4 are from method (2). In addition, we use the method of propensity score matching (PSM) and report the results. All results remain robust in Table 9 & 10.

Table 9. Robustness check results

	(1)	(3)	(2)	(4)
	aUP_1		a$UP_¿2$	
IPO_C	-37.05***		-37.03***	
	(8.298)		(8.296)	
IPO_{NC}		-48.48***		-48.46***
		(10.62)		(10.62)
$IPO_¿$		-26.86***		-26.84***
		(10.19)		(10.19)
Control Variables	Yes	Yes	Yes	Yes
¿ *Effects*	Yes	Yes	Yes	Yes
Observations	1,312	1,312	1,312	1,312

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 10. Robustness check results: Propensity score matching (PSM)

Dependent Variable:	(1)	(2)

Initial returns (IR)		
IPO_C	-23.57**	
	(9.765)	
IPO_{NC}		-22.74*
		(13.23)
$IPO_{¿}$		-23.64**
		(10.01)
Controls	Yes	
¿ Effects	Yes	
Observations	870	

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

4.4.2 *Small and medium-sized enterprises*

SMEs typically experience higher underpricing in IPOs due to greater information asymmetry compared to larger firms. Since the SSE government certification is targeted at SMEs, it's expected to have a more pronounced effect on their underpricing. In Figure 2, we plot the grouped initial returns in boxes, and each group is indexed by an ordered pair (IPO_C, SME), of which there are two dummy variables that can take the values 0 or 1, representing whether the firm is SSE certified and whether it is a small or medium size firm. From the figure, we can see that firms with government certification have lower initial returns, with a lower value in each quartile; and comparing SMEs and other firms horizontally, we can see that SMEs without certification have higher initial returns, with the whole distribution more to the right, and that government certification has a more pronounced effect on SMEs, with SMEs with certification having lower initial returns than others. This is corroborated by the baseline regression results in Table 11, which show that government certification is more effective in reducing SME underpricing, in particular by reducing mispricing in the aftermarket in columns 3-6.

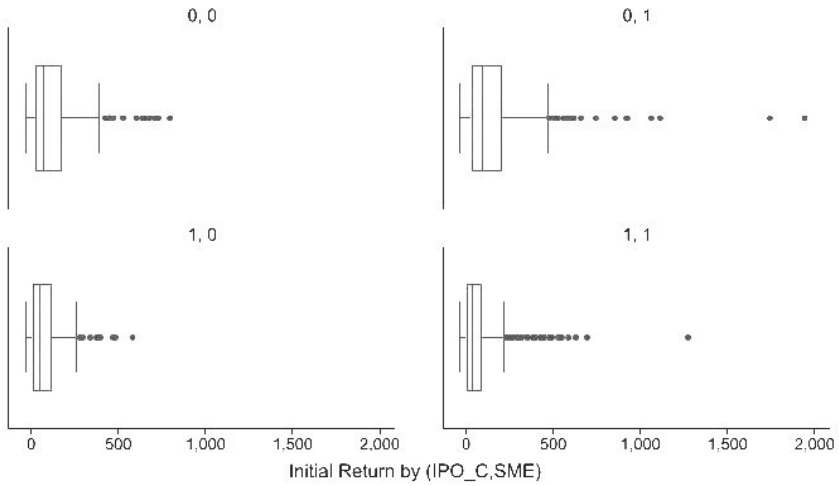

Figure 2. Box-plots for the initial returns
This figure shows the box plots for the initial returns grouped by dummy variables IPO_C and SME, where the first and second row show the distribution of initial returns without and with certification, the first and second column show the distribution of initial returns of other companies and SMEs.

Table 11. The effects of government certification among SMEs

	(1)	(2)	(3)	(4)	(5)	(6)
	IR	IR	Deliberate underpricing		Aftermarket mispricing	
IPO_C	-44.05***		-19.72*		-26.44*	
	(11.41)		(11.61)		(14.11)	
IPO_{NC}		-53.91***		-22.04		-35.75**
		(13.68)		(14.63)		(17.70)
IPO_i		-32.67**		-17.64		-18.03
		(14.36)		(14.08)		(17.11)
$\log(revenu$	0.467	0.628	12.13*	12.17**		
	(6.201)	(6.199)	(6.178)	(6.185)		
Age	-0.0419	0.000651	1.661*	1.670*		
	(0.959)	(0.959)	(0.945)	(0.947)		
Fee	-	-	-	-		

	1.786***	1.781***	1.571***	1.571***		
	(0.158)	(0.158)	(0.164)	(0.164)		
Hot_{market}	33.13***	32.07***	1.124	0.919		
	(11.39)	(11.41)	(11.15)	(11.19)		
$Cold_{market}$	27.06	28.83	68.88	69.08		
	(48.06)	(48.05)	(45.42)	(45.46)		
$Equity retai$	2.496***	2.487***	4.318***	4.318***	-1.578	-1.586
	(0.734)	(0.734)	(0.758)	(0.758)	(1.209)	(1.209)
$Reputation$	13.96	13.58	7.590	7.589	7.315	7.268
	(11.60)	(11.60)	(11.36)	(11.37)	(13.62)	(13.62)
$Volume\%$	275.1***	274.8***			155.0***	155.1***
	(37.57)	(37.55)			(44.40)	(44.41)
$\log(asset)$	15.17	15.36				
	(11.25)	(11.24)				
EPS	-7.738*	-7.642*				
	(4.546)	(4.544)				
$First_{holder}$	-0.890**	-0.906**				
	(0.414)	(0.414)				
$State_{own}$	18.26	18.48				
	(24.84)	(24.82)				
$\log(outissu$					-22.80	-23.20
					(30.00)	(30.01)
$\log(procee$					-29.75	-29.49
					(30.32)	(30.33)
¿ $Effects$				Yes		
$Observatio$	789	789	669	669	669	669

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

5. Conclusions

This research provides a comprehensive analysis of the influence of government certification on IPO underpricing within the Chinese stock market framework. By dissecting initial returns into deliberate underpricing and aftermarket mispricing components, the study employs stochastic frontier analysis (SFA) to reveal that government certifications, especially the national "Little Giant" certification, markedly reduce the extent of

underpricing. The findings underscore the government's signaling role in mitigating information asymmetry and enhancing investor confidence, which in turn curtails the winner's curse and the need for issuers to set conservative offer prices. The study's results indicate that government certification policies can effectively signal the quality of SMEs, leading to a reduction in both the deliberate underpricing as a risk mitigation strategy and aftermarket mispricing driven by speculative trading behaviors. The certification acts as a credible external validation, reducing the perceived uncertainty around the firm's value and, consequently, the level of underpricing. By integrating empirical evidence with theoretical insights, this study contributes to the literature on IPO underpricing and the role of government in shaping capital market outcomes. It offers a robust analytical framework that can be applied to other contexts and markets, enriching the understanding of how government policies can influence financial market behaviors and outcomes.

Declaration of Competing Interest

No potential conflict of interest was reported by the author(s).

Data availability

Data will be made available on request.

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Appendix

1. Two adjustment methods are used: (1) the first-day change of all samples is subtracted from the CSI 300 index[3], which can represent the rise and fall of the stock market; (2) The samples are divided by board and subtracted from the indexes representing the corresponding board, where the CSI 300 index is used for the Main Board and the Growth Enterprise Index[4] is used for the Second Board. For the SSE STAR Board and the BSE, since there is no suitable market index to measure the early listings, so the CSI 300 index is adopted for them. The STAR 50 index[5] and the Beijing Stock Exchange 50 index[6] are adopted for the later listings.

Table A1. The evolution of China's IPO regulatory system

Stage	Time Period	Event	Characteristics
Approval System	1984-1992	Government selected individual enterprises for shareholding reform pilots, approved by the People's Bank of China to issue stocks to local public	Issuers and government departments often simply set the stock par value as the issue price. Without a public securities trading market, stock issuance and subscription were conducted on a small scale or even through administrative directives.
	1993-2001	IPOs in the capital market primarily adopted quota review system	CSRC determined the annual total issuance volume of stocks, which was allocated among provinces and ministries. For enterprises, obtaining an IPO quota was crucial, as it meant success was half-guaranteed.

[3] China Security Index 300. The index is a capitalization-weighted stock market index designed to replicate the performance of the top 300 stocks traded on the Shanghai Stock Exchange and the Shenzhen Stock Exchange.

[4] Growth Enterprise Index (GEI) is officially released by the Shenzhen Stock Exchange (SZSE) on June 1, 2010. It constitutes the core indexes reflecting the operation of stocks listed on the SZSE.

[5] Science and Technology Innovation Board 50 Index, released by Shanghai Stock Exchange (SSE) on 31st, December 2019. The Index is comprised of the 50 largest companies listed on the SSE Science and Technology Innovation Board (STAR Market) as determined by market capitalization and liquidity.

[6] Beijing Stock Exchange 50 Index. Launched in September 2021 as a way to improve financing for China’s small and medium-sized enterprises (SMEs), specifically those considered innovation-based by the exchange, the index tracks the stock performance of 50 of the largest companies listed on the BSE.

Channel System	2011-2005	Regulatory authorities issued the "Notice on the Work Plan Related to Securities Firms Recommending Issuance Applications", requiring securities firms to recommend companies for IPOs with a limit on the number of companies per firm, known as the "Channel System"	Each securities firm could recommend companies for IPOs after approval before continuing with the next one. The number of companies a firm could recommend was determined by its underwriting performance in the previous year. However, it also posed issues such as limiting large firms' channels and reducing industry efficiency due to firms seeking channels for issuers.
Sponsorship System	2005-2015	Revised Company Law and Securities Law came into effect	The Securities Law stipulated that issuers applying for IPOs, convertible corporate bonds, or other securities requiring sponsorship must engage a qualified sponsorship institution. The sponsorship system was officially implemented.
Registration System	2019.7-present	The first 28 companies were officially listed on the STAR Market	The listing of these 28 companies marked the official trial implementation of the registration system on the STAR Market.

2. Table A2. Control variables: multicollinearity test

Variable	VIF	1/VIF
$Leverage$	1.42	0.70
$\log(asset)$	4.16	0.24
EPS	1.17	0.85
$First_{h}older$	1.27	0.79
$State_{own}$	1.32	0.76
$\log(revenue)$	3.24	0.31
Age	1.13	0.89
$Equity_{retained}$	1.62	0.62
Fee	1.93	0.52
$Volume\%$	1.23	0.82
$Reputation$	1.23	0.81
Hot_{market}	1.11	0.90

$Cold_{market}$	1.05	0.96